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A. H. STAFFORD
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WARREN W. MOSES
Chief, Publicity Division

Prepared by B. F. Thrailkill, Chief,
DAIRY DIVISION

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THE MONTANA CREAM GRADING LAW

Rules and Regulations of the Dairy Division of the Montana Department of Agriculture, Labor and Industry

Relating to Babcock Testers, Samplers, Weighers and Graders and the Sanitary Production of Milk and Cream

CREAM GRADERS

All handlers and receivers of milk and cream for manufacturing purposes must be State licensed graders, which means they are deputies of the Montana Department of Agriculture, Dairy Division, and are under direct supervision of that department.

LICENSING OF OPERATORS AND GRADES OF CREAM

(a) All persons engaged, or to be engaged, as cream graders are required to apply to the State Department of Agriculture, through its Dairy Division, for a permit to take the examination for a license as a grader. Examination to be given by the inspectors of the Department of Agriculture and grading to be supervised by the inspectors during the regular inspection period.

(b) Each and every licensed grader of a cream station, creamery, ice cream factory or cheese factory, is required to grade all cream purchased, and in cases of station shipments, to tag all cream graded as follows: "Special, First, or Second," with properly designated tags.

(c) Each and every licensed cream grader must keep a complete record of all cream bought and the various grades. These records, at all times, to be open to inspection by the Commissioner of Agriculture, the Chief of the Dairy Division, or his duly authorized agents and inspectors. Failure on the part of any licensed cream grader to grade cream in the above mentioned manner will be sufficient grounds to revoke his or her license.

(d) No person, firm or corporation receiving or purchasing cream for the manufacture of butter, ice cream or cheese, shall return an inaccurate statement relative to the grade or quality of cream purchased or received.

MONTANA CREAM GRADING LAW

Section 59. **Regulations Governing Purchase of Milk and Cream for the Manufacture of Dairy Products or for Commercial Sweet Cream.** Hereafter all milk and cream purchased by any person for use in the manufacture of butter, cheese or other dairy products within the State of Montana, shall be graded as follows, and shall conform to the following grade requirements:

1. **Commercial Sweet Cream:** Shall consist of cream that is smooth, free from all undesirable odors, clean to the taste, no off flavors, sweet, and to test not more than 20 one-hundredths (.20) of one per cent acidity. (This grade of cream should command a premium.)

2. **Number One Churning Cream:** Shall consist of cream that is smooth, free from undesirable odors, clean to the taste, no off flavors, of good physical condition, and shall test not to exceed 60 one-hundredths (.60) of one per cent acidity. (This grade of cream should be the basis of market price.)

3. **Number Two Churning Cream:** Shall consist of cream that is too high in acid to grade as number one churning cream, that is yeasty, foamy, metallic or contains foreign odors and flavors, or either of them, in a moderate degree, or is slightly stale, and that is edible, but does not meet the requirements of first grade cream.

4. **Unlawful Cream.** All other cream shall be considered as unlawful, and shall consist of cream that is old, musty, rancid, dirty or with marked undesirable odors, and shall not be sold, purchased, or used for any food purposes whatsoever. (Cream of this character will be condemned.)

5. **Penalty:** Failure to comply with the requirements of this section shall constitute a misdemeanor, punishable as provided in Section 49 of the Act, to which this section is added. In addition, if the purchaser is a licensed creamery, cheese factory, ice cream factory, or milk or cream buying or collecting station, or a licensed cream grader, weigher or sampler, such purchaser shall be subject to a revocation of his or its license.

Section 60. **Alkaline Rapid Test.** The alkaline rapid test with phenolphthalein indicator, shall be used in determining the acidity of all cream purchased by cream stations, creameries or plants where cream is purchased for commercial sweet cream or to be manufactured into butter, cheese, ice cream, or other dairy products, or on all cream routes. The testing solution used to be standardized by the State Dairy Division.

Section 61. All milk used in the manufacture of butter, ice cream, or cheese must conform to the standard grading for cream.

Section 62. **Use of Tobacco.** The use of tobacco in any form, in that part of a creamery, receiving station or manufacturing plant, where cream or milk is sampled, weighed, graded, churned or pasteurized, is hereby prohibited.

Section 62. **Cream Graders, Weighers and Samplers.** All persons, firms, co-partnerships, corporations or marketing associations of every

description, receiving or purchasing milk or cream, and all persons collecting on milk or cream routes, milk or cream for the manufacture of cheese, ice cream or butter or for distribution as commercial sweet cream, shall provide a licensed cream grader, weigher and sampler at each point where milk or cream is purchased.

Section 64. **Cream Grader, Weigher and Sampler License and Examination.** No person shall grade, weigh or sample any milk or cream used or to be used in the manufacture of butter, cheese or other dairy products in the State of Montana, without first procuring a license as a cream grader, weigher and sampler from the Department of Agriculture, and passing such examination therefor as may be provided by said department; provided, however, that temporary permits pending the taking of such examination may be issued by the Department for a period of not to exceed thirty (30) days. A fee of Two ($2.00) Dollars shall be paid by the applicant for such license or permit and said license shall expire and be renewable on December 31st of each year.

Section 65. **Employment Unlicensed Persons Prohibited.** Any creamery, cheese factory or other buyer of milk products for manufacturing purposes, who shall knowingly employ as a Babcock Test operator or as a milk and cream grader, weigher and sampler, any person whose license as such, has been revoked, shall be subject to a revocation of its own license.

Section 66. **Posting Price of Butterfat Required.** All creameries, cheese factories or other buyers of milk products for direct sale or for manufacturing purposes, shall post each day in some conspicuous place in their factory or place of business, a schedule of the prices, which they pay for butterfat.

Section 12. The violating of any of the provisions of this Act for which no other penalty is provided, shall constitute a misdemeanor and be punishable as provided in Section 49 of Chapter 93 of the Session Laws of the Twenty-first Legislative Assembly of Montana of 1929.

DEFINITIONS OF FLAVORS AND ODORS FOUND IN CREAM

Metallic: A cream with metallic flavor is never first grade. It is caused by cream coming in contact with rusty or poorly tinned separators, cream cans or other utensils.

Weedy: Cream with this flavor is always second grade or unlawful. It is caused by cows eating large quantities of wild onions, ragweed, fan weed, or other strongly flavored plants. It is most prevalent in early spring or during a period of short pastures. Do not turn cows into a pasture until it is well started. When first turning cows on pastures in early spring, keep them in the feed lot or stable during the night and feed some dry roughage. Take them out of pasture two hours before milking in the evening.

Oily: Oily flavor is always unlawful, and is caused by having

cream near coal oil, gasoline or similar products; also by carelessness in handling separator oil, or using cans in which any of these products have been handled.

Cheesy: Cheesy cream smells and tastes like spoiled cheese. It is cream that has come in contact with a dirty separator or other utensil and subsequently kept at a temperature of or near 90° F. It is never first grade.

Greasy: Greasy cream is never first grade and has a lardy and tallowy taste. It is caused by cream coming into contact with a dirty separator or other dirty utensil. Greasy cream is dirty cream and is invariably too old.

Bitter: Bitter cream has a taste resembling that of quinine. It is cream that has been held too long, though at low temperature. It is never first grade.

Colostrum: Colostrum cream is taken from milk produced by a cow on or before five days after calving. The sale of colostrum milk or cream is prohibited by state law.

Yeasty: Yeasty cream is that which has a tendency to foam and which smells yeasty. It is caused by dirty separators, by dirty utensils, or by exposing the cream to dust and dirt and is always second grade or unlawful. Cream develops foam only when held at a high temperature.

Stale or Musty: A stale or musty cream is never first grade and the term needs no explanation. Stale cream is caused by holding the cream too long in stale cans, or by using stale water in washing and rinsing the cans. Musty cream is the result of holding cream in a cave, cellar, or room having stale or musty surroundings.

Frozen Cream. After cream has been frozen and thawed out, the fat oils off and when this cream is churned it breaks down the body of the butter, giving it a mealy texture. It is impossible to get an accurate test on frozen cream. This kind of cream is never first grade.

Very Sour: Very sour cream has a very high acidity and is never first grade. It is the result of holding cream too long and at too high a temperature.

Medium or Slightly Sour: Slightly sour or medium sour cream has a clean acid taste, and is first grade if it has a desirable odor.

Sweet Cream: Sweet cream is cream which will not curdle in hot water, tea or coffee, and is always first grade if free from objectionable odors.

Ropy Milk and Cream: When certain types of bacteria, peculiar to unclean methods or utensils, develop in milk or cream they decompose it into a ropy or stringy mass which is not usable as a dairy product. Such milk or cream will be condemned.

QUESTIONS AND ANSWERS FOR CREAM GRADERS

I. Question: What is commercial grade cream?

Answer: This grade of cream is smooth, free from all undesirable odors, clean to the taste, no off flavors and sweet, not over .20 of one per cent acidity. This grade of cream should command a premium.

II. Question: What is first grade cream?

Answer: This grade of cream shall consist of cream that is smooth, free from all undesirable odors, clean to the taste, no off flavors or foreign flavors, in good physical condition and shall contain not to exceed .60 of one per cent acidity.

III. Question: What is second grade cream?

Answer: This grade of cream is very high in acid, too high in acid to grade as first grade; that contains undesirable odors and flavors to a moderate degree; that is frozen, foamy, yeasty, metallic, or slightly stale, or that is otherwise unfit for the first grade.

IV. Question: Why is cream that tests 30 to 40% more desirable than cream testing 20%? Give three reasons.

Answer: (a) Cream testing low in butter fat contains extra skim milk which soon sours, causing cream to become high in acid. (b) Low testing cream increases cost in transportation. (c) Low testing cream entails loss of skim milk which should be kept at the farm for feeding purposes.

V. Question: Why should cream be graded? Give three reasons.

Answer: (a) Better butter will invade our markets if we do not grade the same as other sections are doing. Butter made from good cream is worth several cents a pound more than butter made from poor cream. (b) When cream is graded, the farmer who produces good cream gets paid for his extra time and work, while the one who sells second grade cream gets penalized for careless methods. (c) The creameries can make extras and first grade butter from special and first grade cream and find a suitable market for all of it, and, in turn, pay a better price for the butter fat to the farmer.

VI. Question: Name five causes for poor cream.

Answer: (a) Dirty milking. Dirty utensils, to-wit: milking machines, strainers, pails and separator. Separator should be washed after each time used. (b) Improper cooling of cream and not keeping cream cooled while awaiting shipment. (c) Holding cream too long, more than three or four days, before making a shipment. Holding cream in musty cellars, or any place where strong odors prevail. (d) Lack in stirring cream. Cream should be stirred at least TWICE a day. (e) Low testing cream. It is important to have the cream screw set to run the cream at 30 to 40%.

VII. Question: How would you advise a farmer to care for his separator?

Answer: I would impress upon him the importance of washing and sterilizing separator each time it is used.

VIII. Question: When a patron brings you a can of cream, how can you tell whether it is first or second grade?

Answer: The only way to grade cream is by smelling and tasting, and every operator is required to taste each patron's cream, providing it is not spoiled and unfit for food. To grade a delivery of cream: Take the can lid off and note the appearance and odor of the cream, then stir the cream well and taste it. Make an acidity test and grade according to State standard. Any cream under .60 of one per cent, with good flavor and odor, and in good physical condition will grade as first.

IX. Question: What causes cream to sour? How may souring be prevented or retarded?

Answer: Cream or milk becomes sour due to the action of the lactic acid bacteria. These bacteria change the milk sugar into lactic acid. In order to prevent or retard souring of milk or cream it is necessary to have all dairy utensils well washed and sterilized. Milking must be performed in a cleanly manner. Cream must be cooled at once and kept cold until delivered. DO NOT SET CREAM AWAY TO COOL. Cool it by placing it in cold water and stirring same at the time of separating, or by using a cream cooler.

X. Question: How should cream be cared for while in the possession of the cream station or creamery?

Answer: The cream while in the possession of the station or creamery must be cared for by placing it in a cool room or tank of cold water or covered with such material as may be wet down with cold water. **In other words, the operator must see to it that he does his part to care for the cream perfectly while in his charge.**

XI. Question: Describe the practical method of cleaning the dairy utensils. Explain the reason for each step.

Answer: Dairy utensils should first be rinsed with warm water to remove as much of the milk serum and fat as possible that remains on the utensils after being used, then thoroughly cleansed with hot water containing an alkaline solution, then scalded with boiling water or live steam, or rinsed with tepid water with a chemical solution, then let dry.

XII. Question: When cleaning dirty utensils should a brush or a cloth be used? Why?

Answer: Only a brush should be used. A brush is fibrous and does not mat and is easily kept clean. A cloth becomes sour very quickly and imparts odors and flavors to the cream.

XIII. Question: Which is preferable, soap, soap powder or an alkaline wash powder? Why?

Answer: An alkali or soda ash solution cuts the grease and cleanses, while a soap product forms a film and leaves a greasy surface.

XIV. Question: What is the proper temperature to which milk and cream should be cooled? Why and how?

Answer: (a) Milk for factory purposes should be cooled to 55° F., or lower, as soon as possible after milking. (b) Cream should be cooled to 60° F., or lower, at time of separating, or as soon as possible after

separating. The cooling of milk or cream AT ONCE retards the growth of bacteria.

Prompt cooling is not possible by merely letting the cans stand in the air. Air is a very poor conductor of heat. The cans must be set in water. Water cools cream about thirty times as fast as air.

Set the cream cans in a trough, tight box, tank or half barrel containing cold fresh water. If running water is available, let the water run through the tank continuously; if not, fill the tank up with fresh water at least once every 12 hours. If the cooling tank is connected with the stock watering trough, the water needed for the stock serves to cool the cream by running through the cooling tank first.

XV. Question: In transporting milk or cream in cans to the creamery should they be covered or uncovered, wet or dry?

Answer: In transporting milk or cream the cans should be protected by a clean covering during the warm weather, and in the winter they should be protected against freezing.

XVI. Question: Should the cream or milk grader be concerned about the condition in which cans are returned to the farmer? Why?

Answer: The cream or milk grader should always concern himself with the sanitary condition of the cans when they are returned to the cream producer. No rusty cans should be sent out or any improperly washed or sterilized can. If milk or cream be received, stored or kept in cans or other containers such containers should be sterilized with boiling water or live steam after each delivery.

XVII. Question: What responsibility has a licensed cream grader?

Answer: (a) Each operator is required to keep a record of the grade of each patron's cream so that the inspector may look at the daily report and see how the cream is graded. (b) The grader must at all times be fair and honest in his decision, to the best of his or her ability. (c) All graders of cream must be familiar with the Dairy Code, especially those sections that pertain to milk and cream, care of separator, etc.

XVIII. Question: Why is the acidity test used and how?

Answer: The acidity test is used to determine the acid content of the cream. (How sour.) A special strength alkaline solution has been prepared, known as State standard, to be used in an equal proportion with cream. This solution is standardized to determine the acidity at a given point. One measure of the alkaline solution and one measure of cream are used with a phenolphthalein indicator. When mixed, if the solution remains pink the acidity is below the grading line, but if the mixture fades out it shows the acidity to be over the grade line, and all such cream goes into the next lower grade. Equipment necessary for making tests: Two small dippers of equal capacity, one for measuring the cream and the other for measuring the special alkaline solution. 10 c. c. is a convenient size. The one for cream should be provided with a long handle, that is long enough to reach down into the cream can, while the handle of the other should be about six inches long. A white porcelain cup can be used for mixing. In testing for acidity it will be necessary to rinse

out the dipper with distilled water and add the rinsings to the charge. Cream, being more viscous than milk, will adhere more to the walls of the dipper.

XIX. Question: Give five of the most common off flavors found in cream.

Answer: (1) High acid (very sour); (2) Stale or musty; (3) Metallic; (4) Yeasty; (5) Weedy. (See definitions of flavors and odors.)

XX. Question: What responsibility must the transportation companies and creameries assume in the cream grading program?

Answer: (a) The transportation companies must at all times do their part in protecting cream shipments at shipping points, while in transit and at destination, to-wit: Keep cans in cool rooms and out of the sun, provide proper space in baggage cars, wet down cans, or provide special refrigerator cars, as the case may be. (b) The creameries must remove from the depots, docks and unloading stations cream as soon as it arrives and take it to the creamery. In case of Saturday P. M. or Sunday shipments cream must be picked up and taken to the creamery, graded and placed in vats or cold storage.

WEIGHING AND SAMPLING

Sampling is the foundation of the test, and no tester, however skillful, can arrive at a proper test of a delivery of milk or cream if the sample was improperly taken; neither can sampling be done to the best advantage if the sampler does not understand, somewhat, the operations that are to follow. It is much to be preferred that the testing should be done by the one taking the sample, but this in many cases is impossible.

QUESTIONS AND ANSWERS FOR SAMPLERS AND WEIGHERS

I. Question: Why is milk and cream weighed and why are samples of milk and cream taken?

Answer: Milk and cream is purchased on weight and test. A sample of same must be representative and be taken from the entire shipment to determine the fat content.

II. Question: Why must a person whose duty it shall be to take samples of milk or cream have a license?

Answer: The person taking samples of milk or cream is as much responsible for the correctness of the test, or sample, as the licensed tester. Without an accurate sample the test would not be correct.

III. Question: How are samples of milk or cream to be taken?

Answer: Milk or cream to be sampled shall be stirred or mixed until all parts are homogeneous and uniform. Samples shall be representative of the fat content of the product sampled and in cases of composite samples shall be proportionate in amount to the amount of prod-

uct from which the sample is taken, and no part of the composite sample shall be spilled or lost while transferring it to the sample bottle. When any style of tube is used to secure composite samples and the lot of product to be sampled is in containers or cans of different sizes and diameters, different tubes with diameters in proportion to the diameters of the cans or containers must be used. The sampling devices shall be rinsed in the product to be sampled before any part of the product is transferred to the sample bottle.

IV. Question: Why is it so important to stir or pour a shipment of cream or milk and to take a proportionate sample at once?

Answer: It is important that the sample be taken at once after stirring as the butter fat globules start to rise to the top as soon as agitation ceases.

V. Question: What equipment is used in taking milk or cream samples?

Answer: A regulation milk stirrer and a sample dipper or a McKay cream sampler or a milk thief, proper sample bottles with tight covers, either rubber or ground glass to overcome evaporation, and the necessary preservative tablets in the case of composite samples.

VI. Question: What must a licensed sampler or weigher observe at all times?

Answer: He must at all times observe the condition of the scales with which he weighs shipments of milk or cream. He must be sure that they break easily. He must keep his scales clean and in good working order. Scales should be accurate and sensitive to a quarter of a pound.

VII. Question: Give eight important points in taking samples.

Answer: (1) Write the patron's name plainly on the receiving sheet; (2) Balance the weigh scales carefully; (3) Weigh cream carefully; (4) Record the gross weight of cream and can; (5) Note the appearance of, taste, and grade all cream; (6) Place number of sample jar opposite patron's name; (7) Take an accurate sample; (8) Empty cream, reducing steamings before getting tare weight.

VIII. Question: Describe in full: (a) Correct cream sample jar; (b) Correct milk sample jar.

Answer: (a) Any clean, dry, wide-mouthed bottle holding two ounces is suitable for receiving cream samples. It should be provided with a tightly fitting screw cap or cover to prevent evaporation of moisture. (b) A correct milk sample jar for the composite milk sample should be a wide-mouthed jar or bottle holding enough milk for a seven or fifteen day sample. The jar must have a ground glass stopper or a rubber cork, a place for patron's number, or a metal number plate attached thereto.

BABCOCK METHOD

I. APPARATUS

(a) Test Bottles—The standard Babcock test bottles for milk and cream shall be as follows:

(1) 8 per cent, 18 gram, 6 inch milk test bottles.

(2) 50 per cent, 9 gram, 6 inch cream test bottles, short neck.

(3) 50 per cent, 9 gram, long neck, 9 inch cream test bottles.

(4) 50 per cent, 18 gram, long neck, 9 inch cream test bottles.

(1) 8 per cent, 18 gram, 6 inch milk test bottle. The total height of the bottle shall be 150-165 mm. (5.9-6.5 inches.) The bottom of the bottle shall be flat, and the axis of the neck shall be vertical when the bottle stands on a level surface. The charge of milk for the bottle shall be 18 grams.

Bulb—The capacity of the bulb to the junction with the neck shall be not less than 45 cc. The shape of the bulb shall be either cylindrical or conical. If cylindrical, the outside shall be between 34 and 36 mm.; if conical, the outside diameter of the base shall be between 31 and 33 mm., and the maximum diameter shall be between 35 and 37 mm.

Neck—The neck shall be cylindrical and of uniform diameter from at least 5 mm. below the lowest graduation mark to at least 5 mm. above the highest. The top of the neck shall be flared to a diameter of not less than 10 mm. The graduated portion of the neck shall have a length of not less than 63.5 mm. The total per cent graduation shall be 8. The graduations shall represent whole per cent, five-tenths per cent, and one-tenth per cent, respectively, from 0.0 to 8.0 per cent. The tenths per cent graduations shall be not less than 3 mm. in length, and the five-tenths per cent graduations not less than 4 mm. in length and shall project 1 mm. to the left; the whole per cent graduations shall extend at least half-way around the neck to the right and shall project at least 2 mm. to the left of the tenths per cent graduations. Each whole per cent graduation shall be numbered, the number being placed to the left of the scale. The capacity of the neck for each whole per cent on the scale shall be 0.20 cc. The maximum error of the total graduation or any part thereof shall not exceed the volume of the smallest unit of the graduation.

(2) Fifty per cent, 9 gram, short neck, 6 inch cream test bottle. The total height of the bottle shall be 150-165 mm. (5.9-6.5 inches.) The bottom of the bottle shall be flat, and the axis of the neck shall be vertical when the bottle stands on a level surface. The charge of cream for the bottle shall be 9 grams.

Bulb—The capacity of the bulb to the junction with the neck shall be not less than 45 cc. The shape of the bulb shall be either cylindrical or conical. If cylindrical, the outside diameter shall be between 34 and 36 mm.; if conical, the outside diameter of the base shall be between 31 and 33 mm., and the maximum diameter between 35 and 37 mm.

Neck—The neck shall be cylindrical and of uniform diameter from at least 5 mm. below the lowest graduation mark to at least 5 mm. above

the highest. The top of the neck shall be flared to a diameter of not less than 15 mm. The graduated portion of the neck shall have a length of not less than 63.5 mm. The total per cent graduation shall be 50. The graduation shall represent five per cent, one per cent, and one-half per cent, respectively, from 0.0 to 50 per cent. The five per cent graduations shall extend at least half way around the neck to the right; the one-half per cent graduations shall be not less than 3 mm. in length; and the one per cent graduations shall be intermediate in length between the five per cent and the one-half per cent graduations and shall project 2 mm. to the left of the one-half per cent graduations. Each five per cent graduation shall be numbered (thus: 0, 5, 10—45, 50), the number being placed to the left of the scale. The capacity of the neck for each whole per cent on the scale shall be 0.1 cc. The maximum error in the total graduation or any part thereof shall not exceed the volume of the smallest unit of the graduation.

(3) Fifty per cent, 9 gram, long neck, 9 inch cream test bottle. The same qualifications shall apply to this bottle as to the 50 per cent, 9 gram, 6 inch cream test bottle, with the exceptions, however, that the total height of this bottle shall be 210-229 mm. (8.25-9.0 inches), that the graduated portion of the neck shall have a length of not less than 120 mm., and that the maximum error in the total graduation or any part thereof shall not exceed the volume of the smallest unit of the graduation.

(4) Fifty per cent, 18 gram, long neck, 9 inch cream test bottle. The same specifications shall apply to this bottle as to the 50 per cent, 9 gram, 9 inch cream test bottle, with the exception, however, that the charge of cream for this bottle shall be 18 grams.

Each bottle shall bear on the top of the neck above the graduation, in plain legible characters, a mark denoting the weight of the charge to be used, viz., "9 grams" or "18 grams," as the case may be.

Each bottle shall bear a permanent identification number, placed thereon by the manufacturer, and the word "Sealed."

Each bottle shall be constructed by necessary strength to withstand the strain to which it will be subjected in the centrifuge.

The mercury and cork, alcohol and buret, and alcohol and brass plunger methods may be employed for the rapid testing of the bottles, but the accuracy of any questionable bottle shall be determined by calibration with mercury (13.5471 grams of clean dry mercury at 20° C. to be equal to five per cent on the scale of an 18 gram bottle and ten per cent on the scale of a nine gram bottle), the bottle being previously filled to zero with mercury.

(b) Pipette—The standard milk pipette shall be as follows: Total length, not more than 330 mm. Outside diameter of suction tube, 6-8 mm.; length of suction tube, 130 mm.; outside diameter of delivery tube, 4.5-5.5 mm.; length of delivery tube, 100-120 mm.; distance of graduation mark above bulb, 15-45 mm.; nozzle, straight; graduation, to contain 17.6 cc. of water at 68° F., when the bottom of the meniscus coincides with the mark on the suction tube; delivery, 5-8 seconds. The maximum error in the graduation shall not exceed 0.05 cc. The pipette is to be

marked "Contains 17.6 cc." The pipette shall be tested by measuring from a buret the volume of water (at 68° F.) which it holds up to the graduation mark.

(c) Acid measure—The device employed to measure sulphuric acid, whether a graduated cylinder or the pipet attached to a Swedish acid bottle, shall be graduated to deliver 17.5 cc.

(d) Cream weighing scales—The standard cream scales shall have a sensibility reciprocal of 30 mg., i. e., the addition of 30 mg. to either pan of the scales, when loaded to capacity, shall cause a deflection of the pointer of at least one division on the graduation. The scales shall be set level upon a stable support and be protected from drafts.

(e) Weights—The standard cream test weights shall be 9 grams and 18 grams, respectively, and shall be plainly marked "9 grams" or "18 grams" as the case may be. They shall be made of material capable of resisting corrosion or other injury, shall preferably be of a low, squat shape, with rounded edges, and shall be verified at frequent intervals by comparison with standardized weights.

(f) Centrifuge or "tester"—The standard centrifuge, however driven, shall be constructed throughout and so mounted as to be capable, when filled to capacity, of rotating at the necessary speed with a minimum of vibration and without liability of causing injury or accident. It shall be heated electrically or otherwise, to a temperature of at least 55° C. (130° F.) during the process of centrifugalizing. It shall be provided with a speed indicator—permanently attached if possible. The proper rate of rotation may be ascertained by reference to the table. By "diameter of wheel" is meant the distance between the inside bottoms of opposite cups measured through the center of rotation of the centrifuge wheel while the cups are horizontally extended.

Diameter of wheel in inches....	10	12	14	16	18	20	22	24
Number of revolutions per minute	1074	980	909	848	800	759	724	693

(g) Dividers or calipers, for measuring the fat column.

(h) Water bath for cream samples, provided with a thermometer and a device for maintaining a temperature of 100° to 110° F.

(i) Water bath for test bottles, provided with a thermometer and a device for maintaining a temperature of 130° to 140° F.

II. CHEMICALS

(a) Commercial concentrated sulphuric acid, of specific gravity 1.82-1.83 at 20° C. (68° F.)

(b) Glymol of specific gravity not to exceed 0.85 at 20° C. (68° F.)

III. COLLECTION AND PREPARATION OF SAMPLES

(a) Milk—The quantity of sample required will depend upon the number of determinations to be applied. For the usual analysis 250-500 cc. (½-1 pint) of sample should be furnished; for the fat determination only, 50-60 cc. (approximately 2 fl. oz.) of sample will suffice. Bottled milk may be sampled by the collection of one or more bottles as prepared for sale. Composite samples shall be a product of not over one week and shall be tested as soon as possible.

Bulk milk shall be thoroughly mixed before the sample is withdrawn. This result is best accomplished by pouring the milk from one clean vessel into another three or four times. When this is impossible, the milk shall be thoroughly and vigorously stirred for at least one-half minute with a suitable appliance long enough to reach the bottom of the container. If cream has formed on the milk, the mixing shall be continued until all cream is detached from the sides of the vessel and evenly emulsified throughout the liquid.

Samples shall at all times be kept in non-absorbent containers, sealed air-tight, and held in the cold—but not allowed to freeze—until ready for examination. When transported by mail, express, or otherwise, the containers shall be filled, tightly stoppered, and marked for identification.

A necessary amount of preservative (corrosive sublimate, potassium bicarbonate, or formaldehyde) may be used, except in cases where the presence of preservative may be objectionable in connection with the physical or chemical tests to be applied in addition to the determination of fat.

Before withdrawing a portion for test, the sample shall be poured into a clean empty receptacle and back until a homogeneous mixture is assured. Immediately before pipetting, the sample shall be brought to a temperature of 15-20° C. (56 to 68° F.) If lumps of cream or butter do not completely disappear, warm the sample to about 38° C. (100° F.) and mix thoroughly. Curdy and churned samples are not dependable.

(b) Cream—The same instructions regarding collection of samples and use of preservative apply here as given under (a) milk. Samples shall be tested as soon as practicable and not later than three days after they are taken. Composite samples representing portions of consecutive deliveries by the same patron are unreliable.

Immediately before testing, mix the sample by shaking, pouring, or stirring until it pours readily, and a uniform emulsion has been secured. If the sample is very thick, warm it to 30°-35° C. (aproximately 85° F.) and then mix. In case lumps of butter have separated, heat the sample to 38° C. (100° F.) or, if necessary, to 50° C. (122° F.) by placing in a warm water bath. Mix thoroughly and weight out at once. In commercial testing on a large scale, it may be advisable to warm all samples to 38°-50° C. (100°-122° F.) in a water bath previous to mixing. Great care should be exercised to avoid overheating the sample, thereby causing the cream to "oil off." This precaution is especially necessary in the case of thin cream.

IV. DETERMINATION OF FAT

Testing Milk. The milk from which the sample to be tested is taken shall be thoroughly mixed by pouring from one vessel to another three times. The sample to be tested shall consist of eighteen grams by weight or seventeen and six-tenths cubic centimeters, as measured in a standard pipette. The standard strength of the acid used for all testing of milk or cream shall be indicated by the specific gravity, which shall not be less than one and eighty-two hundredths, nor more than one and eighty-three hundredths, as determined by a standard hydrometer. After properly mixing the sample of milk and acid in the test bottle, centrifuging shall be for periods of five minutes, two minutes, and one minute. After the first period of centrifuging, water shall be added, sufficient to fill the test bottle up to the base of the neck and after the second centrifuging, water shall be added sufficient to raise the fat in the neck of the test bottle to near the top of the graduation. The water used to fill the test bottles shall be at a temperature of one hundred and forty degrees (140°) Fahrenheit or more. After the last period of centrifuging, the test bottles shall be immersed in a bath prepared for the purpose, which shall consist of water at not less than one hundred and thirty degrees (130°) nor more than one hundred and forty (140°) degrees Fahrenheit, and they shall remain immersed for at least ten minutes, and the temperature of the bath shall be kept between the temperatures before named for the full period of immersion. The test shall be read immediately after the test bottles are taken from the bath. Dividers shall be used to determine the length of the fat column in the neck of the test bottles. The reading shall be from the bottom of the lower meniscus to the top of the upper meniscus of the fat column.

Testing Cream. The method of testing cream shall be the same as for milk, except that all samples of cream tested shall be weighed by either the nine or eighteen gram method, and the reading of the fat column in the neck of the test bottle shall be from the bottom of the lower meniscus to the bottom of the upper meniscus. Glymol must be used to destroy the upper meniscus, and must be added just before reading, and the reading shall be from the bottom of the lower meniscus to the bottom of the glymol on the top of the fat column.

QUESTIONS AND ANSWERS RELATING TO THE OPERATION OF THE BABCOCK TEST

All operators should study up on these thoroughly as a written examination will be given by one of our deputies and no licenses will be renewed or issued to any operator having a grade of less than 75 per cent.

1. Why must a person whose duty it shall be to operate the Babcock Test for butterfat in milk and cream where milk and cream is purchased on the butterfat basis have a license?

Answer: The person operating the Babcock Test for butterfat in milk and cream must be responsible for the correctness of the test.

Question No. 2: How does a person obtain a license to operate the Babcock Test?

Answer: A person desiring to operate the Babcock Test must first apply to the Dairy Division, Department of Agriculture, or to one of the deputy inspectors if present, for permission to take the Babcock Tester's examination. After passing the written examination, as well as having shown a practical knowledge of operating the Babcock Test, a license is issed to the successful applicant by the Montana Dairy Division.

Question 3: Outline briefly the method for operating the Babcock Test for milk.

Answer: (1) Mix sample of milk thoroughly.
(2) Quickly fill 17.6 cc. pipette to mark with milk temperature 56° to 68° F.
(3) Run milk into test bottle.
(4) Fill acid measure to mark or fill dipper with acid and pour into test bottle.
(5) Mix milk and acid with a rotary motion.
(6) Put bottles in centrifuge and whirl not less than 5 minutes at proper speed.
(7) Add fairly hot water up to neck of bottle.
(8) Whirl 2 minutes and fill bottle up to near the top with hot water.
(9) Whirl 1 minute.
(10) Read results at temperature of 130° to 140° F.

Question 4: Give 3 important points to observe in adding acid to the test bottle.

Answer: (1) The temperature of the acid should be somewhere between 50° and 70° F.
(2) In pouring the acid in the test bottle containing the milk, the test bottle is held in an inclined position so the acid will follow the inside wall to the bottom of the milk.
(3) Rinse neck of bottle with acid.

Question 5: How is the fat column in a milk test read?

Answer: Hold the test bottle upright, having the graduated scale on the level with the eye. The length of the fat column is measured with a pair of dividers, one point of which is placed at the lowest point of the bottom curve of the fat column, and the other at the upper limit of the fat column. The dividers are then removed without changing the position of the points. Place one point on the zero mark of the scale, and the other point will be on the exact per cent of fat in the milk test.

Question 6: Describe the appearance of a perfect test.

Answer: When the testing is done properly
(1) The line of division between fat column and the liquid is nearly a straight line.
(2) The fat appearing in the neck of the test bottle is of a clear golden yellow to amber color, and is free from specks of any kind.

Question 7: State briefly the points in the method of testing cream for butterfat.

Answer: (1) Thoroughly mix the sample (heat the cream to 85° F. so that it will flow easily, and mix more readily).
(2) Balance the cream test bottle on a cream test scale.
(3) Place an eighteen or nine gram weight on the opposite pan, and balance the pans by pouring cream into the test bottle.
(4) Add a dipper of acid, mix the acid with the cream with a rotary motion.
(5) After a chocolate color is reached, fill bottle to the neck with warm water.
(6) Place bottle in centrifuge, whirl 5 minutes.
(7) Fill neck of bottle with hot water, and whirl one minute. If you do not get good results with this method, add less water the first time and whirl 3 times.
(8) Place test in water bath at 130° to 140° F. at least 5 minutes and do not let temperature go below 130°.
(9) Add Glymol or red top reader just before reading and read some as milk tests.

Question 8: What is the standard of accuracy required in a cream test scale in the State of Montana?

Answer: The addition of 30 milligrams to the scale when loaded to capacity should cause a deflection of the pointer not less than one division on the graduation.

Question 9: Name 4 important points in the care of a cream test scale.

Answer: The scale should be: (1) set on a solid table, free from vibration, (2) set level, (3) and protected from drafts. (4) Keep locked when not in use.

Question 10: How is a very thick sample of cream prepared for test?

Answer: The sample of cream is placed in a water bath which is of a temperature from 100° to 110° F. for a few minutes. Then thoroughly mix the sample and weigh it up.

Question 11: What is a good way to break up lumpy cream in preparing it for a test?

Answer: Pour lumpy cream through a small sieve. The lumps caught in the sieve are forced through with either a spoon or finger.

Question 12: How long does the State of Montana require the factories or cream receiving stations to hold the samples?

Answer: Until 5 P. M. the day after purchased. In case of Sundays or holidays, the samples are held until 5 P. M. the first working day.

Question 13: Name 8 ways in which a person might get inaccurate results in a cream test.

Answer: (1) Unclean glassware (greasy).
(2) Failure to thoroughly mix the sample before weighing.
(3) Failure to balance bottle before weighing cream.

(4) Oil in the sulphuric acid.
(5) Running centrifuge at too low a speed, or not whirling the tests long enough (less than the prescribed time).
(6) An attempt to read tests that have a curdy or black fat column.
(7) Reading tests too cold or too hot.
(8) Poor dividers.

Question 14: What precautions must a licensed Babcock operator take at all times if he wishes to retain his license?

Answer: (1) Observe accuracy before speed.
(2) Be sure at all times that the right covers are returned to the right sample jars.
(3) Be sure that covers on the sample jars are tight to avoid the possibility of evaporation from the samples.
(4) Where the tester does not write the checks, it is well to keep a record of all tests turned into the office.
(5) Use only clean glassware in testing.
(6) Save each and every sample the required time.
(7) Do not attempt to read tests that are not clear.

Question 15: Give 7 common reasons why cream tests vary.

Answer: (1) Variation in speed of separator.
(2) The rate of inflow into the bowl.
(3) Variation in the temperature of the milk at the time it is separated.
(4) Variation in the milk test from time to time.
(5) Changing the cream or milk screw on the separator.
(6) Separating milk through an unclean separator.
(7) Variation in the amount of flush water used.

Question 16: Does souring of cream increase the butterfat content of cream? Explain the reason.

Answer: The souring of cream does not change the butterfat content. Holding the cream at a high temperature in an unsealed container will cause evaporation, which causes an increase in test and a corresponding decrease in volume. It does not increase nor alter the number of pounds of butterfat in a can of cream.

Question 17: How should a sample of cream that is partially churned be prepared for a test?

Answer: Heat the partially churned sample of cream to about 135° F. Then cool in a water bath below 70° and shake sample while cooling so that fat will solidify uniformly throughout the sample. Then rapidly weigh up the sample for test and report the results. No accurate test can be made on cream that has been churned.

Question 18: Describe a method of first aid in case sulphuric acid splashes over a person's hands, face or clothes.

Answer: As a first aid, every tester should have a bottle containing a strong solution of baking soda set near the testing table. When sul-

phuric acid is spilt over hand only, use cold water immediately to wash off the acid. When sulphuric acid is splashed on the face use the solution of baking soda in preference to cold water to wash off the acid. The baking soda will check the action of the acid more rapidly than the cold water. Do not hesitate to check the action of the acid at once, as acid burns are hard to heal. To check the action of sulphuric acid on clothing use a solution of baking soda as water alone will not check the action of the acid.

DIRECTIONS FOR TAKING SAMPLES ON THE FARM

These rules are given for the purpose of checking the composite tests at the factory or station.

Samples are to be taken on the farm on same dates as taken at factory. Failure to take a sample of each entire shipment will necessitate the starting of a new period.

FOLLOW EXPLICITLY THE DIRECTIONS GIVEN BELOW FOR TAKING SAMPLES

1. Take all samples just before cans are closed and tagged for shipment.

2. Stir each can with regulation milk stirrer until the milk is thoroughly mixed. Any failure to properly stir the milk will result in an improper test—any neglect here means failure.

3. Take sample dipper full from each full can as stirred, and put same in cup or fruit jar. That is, take sample from each can before stirring the other cans.

4. In taking samples from any can not full, the sample should be in proper proportion to the amount of milk in can. That is, a can half full should have a half dipper sample taken; a can three-fourths full should have a three-fourths dipper full, and so on.

5. When a proper sample has been taken from each can and put in fruit jar or other container, then take one sample dipper full of milk from the jar and put in your regulation Mojonier Sample Bottle. This constitutes your sample of that day's milk.

6. Use only ¾ oz. dipper in taking samples.

7. Repeat the above process daily through the seven or eight day period, or the 15 day period, or whatever period is arranged by the factory for the taking of their composite samples.

8. Shake sample bottles daily. Unfair samples.

> "No person shall take, extract or return to any creamery, milk plant, cheese factory or factory of milk products, any unfair, fraudulent or manipulated sample of any cream or milk purchased, received, hauled, sold or delivered."

Sample sent for check testing should be preserved with corrosive sublimate or two drops of formaldehyde.

9. Sample preserved can not be sent by mail. Send by express and label "poison."

SANITARY PRODUCTION OF MILK AND CREAM

HOW TO PRODUCE FIRST GRADE CREAM

Every farmer in the state can produce first grade cream by reasonable attention to the following simple and fundamental principles: cleanliness of separator, promptness of cooling and frequency of delivery.

CLEAN SEPARATOR

The separator is the collector of many of the impurities contained in milk. If cream of good quality is to be secured it is obvious that the separator must be cleaned thoroughly after each separation. If not washed and freed from all remnants of milk of the previous separation, the separator becomes a seat of contamination and a source of unclean and filthy cream, the disastrous consequences of which no subsequent treatment and care of the cream can overcome.

This does not mean that no attention should be paid to cleanliness and care of milk before separation. Milk produced under insanitary conditions will not produce good cream, even if passed through a clean separator. In the production of good milk, clean stables, clean cows, clean milking and clean utensils are essential, but all these precautions come to naught, unless the milk is run through a clean separator; and experience has shown that it is this negligence in the care of the separator that has done more harm to the quality of the cream than any or all of the factors entering into the care of the milk before separation, combined.

HOW TO KEEP THE SEPARATOR IN SANITARY CONDITION

Wash the Separator After Each Separation.—Immediately after separation, flush the separator with water until the discharge from the skim milk spout is clear. This removes most of the remnants of milk and cream, and loosens the separator slime in the bowl, making subsequent washing easy. Now take the bowl apart and wash with hot water, containing some good washing powder, all parts of the bowl, discharge spouts and buckets. Then rinse them with scalding hot water and allow all parts to drain in a clean place. All other milk utensils should receive the same treatment. Do this after each separation.

Other Advantages of a Clean Separator.—Aside from insuring cream of good quality a clean separator will skim more closely and last longer than a separator that is not thoroughly washed after each separation.

The slime which accumulates in the bowl reduces the space in which the milk is exposed to the separating influence of the centrifugal force. The separating efficiency is therefore diminished and more fat is lost in the skim milk.

If the bowl is not washed after each separation the impurities and acid which form in it, due to decomposition of the remnants of milk, tend to corrode the bowl and internal contrivances and to shorten the life of the separator.

PROPER COOLING

Cool the Cream Immediately After Separation by Setting the Can in Cold Water.—The spoiling of cream as well as the decomposition and putrefaction of other food stuffs is caused by germ life, bacteria, yeast and molds. Like other living organisms germs require warmth to thrive. In the absence of warmth they are inactive and are unable to continue their work of destruction.

When the cream comes from the separator it is warm and in ideal condition for bacterial decomposition and spoiling. If it is cooled promptly the activity of the bacteria is checked and the cream will keep sweet for a reasonable length of time. The lower the temperature to which it is cooled the longer it will keep in normal condition. Cooling to the temperature of the water available on the average farm alone greatly retards bacterial action and prevents spoiling. Cream should be cooled at once after it leaves the separator.

HOW TO COOL CREAM

Prompt cooling is not possible by merely letting the cans stand in the air. Air is a very poor conductor of heat. The cans must be set in water. Water cools cream about thirty times as fast as air.

Set the cream cans in a trough, tight box, tank or half barrel containing cold fresh water. If running water is available, let the water run through the tank continuously; if not, fill the tank up with fresh water at least once every twelve hours. If the cooling tank is connected with the stock watering trough, the water needed for the stock serves to cool the cream by running through the cooling tank first.

DO NOT MIX WARM CREAM WITH COLD CREAM

Stir the cream frequently to hasten the cooling and to keep it in smooth condition. Do not pour warm cream into cold cream; this practice spoils the whole batch. Cool the warm cream in a separate can before mixing. The dairy supply houses are now putting on the market cooling tanks which provide for two cans for this very purpose. If you cannot conveniently make your own tank, or have it made locally, ask your creamery to secure a tank for you, or write to any reliable dairy supply house.

OTHER ADVANTAGES OF PROMPT COOLING BY SETTING CANS IN WATER

Aside from checking fermentation and therefore avoiding rapid spoiling of the cream, the use of the cooling tank serves to take the animal heat out of the cream, preventing the cream and butter from developing an unpalatable smothered taste, which greatly depreciates the market value of butter.

When promptly cooled and frequently stirred the cream remains in proper mechanical condition so that it can be readily transferred without excessive loss due to sticking to the can. This also makes possible

the taking of representative samples therefrom, which in turn insures accurate tests. **One of the fundamental causes of irregular and incorrect cream tests lies in the poor mechanical condition of the cream when sampled.** It is difficult to take a correct sample from cream that has not been cooled promptly and properly, nor stirred frequently, or that is otherwise in poor condition.

FREQUENCY OF DELIVERY

Cream is a highly perishable product. Like other similar products it is best when fresh and should therefore be marked as early as possible. **Age will deteriorate cream under any condition.** While proper care retards such deterioration, it cannot entirely prevent it; hence delivery should be made often, preferably three times per week in summer and twice per week in winter.

THE PROPER RICHNESS OF THE CREAM

Adjust the cream screw of the separator so as to secure cream testing about 35 to 45 per cent fat. Low-testing cream sours and spoils more rapidly than high-testing cream, so that by the time it reaches the creamery it is often in condition unfit to be made into good butter. In the spoiled and curdy condition, it also makes difficult accurate sampling and testing. It is undesirable further, because it diminishes the amount of skim milk available for the feeding of calves and pigs; it increases the cost of transportation for every pound of butter fat shipped; it makes impracticable the use of a reasonable amount of starter in the creamery, and starter is essential for the production of the best quality of butter; it does not churn out exhaustively and yields an excessive amount of buttermilk, augmenting the loss of fat and thereby reducing the churn yield.

There are no advantages in producing a cream testing higher than 45 per cent. Too rich cream is undesirable because it tends to clog the separator; it increases the loss in handling due to sticking to the receptacles; it makes difficult accurate sampling and thereby tends to yield incorrect tests.

It is desirable to produce somewhat richer cream in summer than in winter to prevent excessive souring in summer and difficult handling in winter.

PROTECTION OF CREAM IN TRANSIT

The cream should be kept in the cooling tank until it leaves the farm. While being hauled on the wagon and waiting for the train at the station, it should be properly protected against heat in summer and cold in winter. This can be done by using a covered wagon for hauling, or by hauling the cream in insulated cans, or by slipping a jacket over the cans, or by covering the cans with a wet blanket in summer and a dry blanket in winter.

If the cans arrive at the station long before train time, as is often the case, a cooling tank filled with water and located in the shade, should

be provided so that the cream is reasonably protected against the hot summer weather.

SOUR CREAM TESTS NO HIGHER THAN SWEET CREAM

The impression among many cream producers appears to be that sour cream contains more butterfat and yields a higher test than sweet cream. For this reason some farmers purposely keep their cream until it sours and often store it in a warm place to hasten the souring. This impression is entirely erroneous. **The acidity or sweetness of cream has no effect on its fat content, nor on the resulting test.**

On the other hand this practice of causing the cream to become extremely sour spoils its chances to make good butter and renders difficult the taking of a representative sample and thereby lessens the reliability of the test; for the accuracy of the test depends above all things on the accuracy of the sample.

BACTERIA IN MILK

All milk, unless collected under very exceptional circumstances, contains some bacteria (single-celled plants so small that they can not be seen with the naked eye). Milk furnishes all the food material and other necessary conditions for bacterial growth. The bacteria commonly found in milk grow most rapidly at temperatures between 80° and 100° F. Some bacteria, at maturity, divide to form two bacteria, and under favorable conditions the two new individuals may become full grown and repeat the process of division in from 20 to 30 minutes. At temperatures below those most favorable the growth of bacteria is retarded but continues slowly, except at very low temperatures. Growth at 70° F. is rapid, at 50° F. it is much retarded, and at 40° F. or below it is very slow. A few kinds of bacteria continue to grow, however, even at the freezing point.

The number of bacteria in milk depends, first, on the number of bacteria in the udder of the cow, secondly, on the amount of contamination from outside sources, and thirdly on the rapidity of the bacterial growth. The rate of growth or increase depends on the temperature at which the milk is held.

IMPORTANCE OF CLEAN MILK TO THE PRODUCER

Clean milk benefits not only the consumer but the milk producer as well. Most producers of market milk have experienced the chagrin of having a shipment of milk refused or returned because it reached the market sour, tainted, or otherwise in poor condition. Although the milk may be used for feeding pigs, it usually is a complete loss to the producer, since the cost of transportation back to the farm usually exceeds the value of the milk. Frequently, also, the producer depends on a certain market as an outlet for his milk and has no means for utilizing small quantities at uncertain intervals, even if he had it at the farm. Another important consideration is the unpleasant effect which the receipt of sour, tainted, or otherwise unsalable milk has upon the purchaser. Delivering milk of that kind usually results in the loss of con-

fidence of the dealer, or, if it is delivered directly to the consumer, the loss of customers. Clean milk means fewer complaints, a better class of patrons, and a steady market for the product.

THOSE WHO HANDLE MILK SHOULD BE HEALTHY

Some communicable diseases which do not originate with the cow may be carried by milk. The bacteria causing these diseases drop into the milk, are introduced unknowingly by the milker, are carried by flies, or come from contaminated utensils. Many of these bacteria grow in milk, and "milk-borne" epidemics have been caused by them. Diseases which may be carried by milk include: Tuberculosis, typhoid fever, diphtheria, scarlet fever, and septic sore throat. Bacteria causing these diseases can be carried by people who are apparently well, or at least are well enough to perform their work.

Great care must be taken to have only healthy people handle milk or anything with which it may come in contact. No one should go from a sick room where an infectious disease exists to take part in any dairy operations.

Have your cattle tested for tuberculosis for it is generally conceded that tuberculosis may be transmitted by milk, from cattle to human beings, especially children.

HAVE PURE WATER

The water supply of dairy farms should be carefully examined and its purity established. The farmer owes this protection to his own family, to his business interests, and to those who use milk that comes from his dairy. Contamination of water may lead to typhoid fever. All water on the farm, even that to which only the cattle have access, should be above suspicion as to its purity. If cows wade in polluted water, disease bacteria may adhere to their bodies and later fall into the milk pails. Especial attention should be paid to the purity of the water with which milk pails and other utensils are washed.

KEEP DOWN THE BACTERIAL COUNT IN YOUR MILK

Farmers should produce and market milk and cream having a low bacterial count. In most places health regulations require it for the protection of the consuming public. High bacterial counts usually result in economic losses from sour milk and low-grade dairy products. Such low-grade products sell at a lower price and tend to limit consumption.

The body of the cow, especially that part of the belly, flanks, and udder that is immediately above the milk pail, may be the source of many bacteria in the milk. Manure, loose hairs, bedding, and other foreign matter carrying great number of bacteria drop into the pail during the milking.

The best method of prevention is to have the cows clean at milking time. Far more reason exists for the daily grooming of a cow that produces human food than of a horse. Custom, however, demands that the

horse be kept clean, and that custom should include cows on farms where milk is produced. Cows on pasture usually keep cleaner than when in the barn, but though they appear clean they may be very dusty and need to be brushed before each milking. When kept in stables cows require a thorough cleaning at least once every day. It is well to clip the long hairs from the udder, flanks, and tail, in order that dirt may not cling to them. After grooming and before milking, the udders, flanks, and bellies of the cows should be carefully wiped with a clean, damp cloth to remove any dust or loose hairs. If very dirty, these parts should be washed clean. Sufficient bedding, proper stable construction, and frequent removal of manure are also things which will aid in keeping the cows clean. Cleaning cows has been found to have a marked effect in lowering the bacterial count.

WASH AND STERILIZE DAIRY UTENSILS

Dairy utensils which have not been properly washed and sterilized contain large numbers of bacteria. Indeed, dirty utensils are usually the source of most bacteria found in market milk at the time of its production and before bacterial growth has begun.

The best remedies for dirty utensils are plenty of hot water, an alkali washing powder, a stiff brush and steam. First of all, the utensils must be thoroughly cleansed, as sterilization is not a substitute for washing. First, rinse the utensils in cold or lukewarm water; then wash thoroughly until clean with hot water and washing powder, using a stiff brush. Avoid rags, greasy soaps, and soap powders.

Sterilization is best accomplished with steam. Proper sterilization not only kills bacteria but heats the utensils enough to dry them immediately, thus preventing rust. Where steam is not available utensils may be immersed in water and boiled 5 to 10 minutes, but this method is cumbersome. Steam for dairy utensils is available for even the smallest dairies, by means of a simple steam sterilizer.

MILKING AND CARE OF MILK

Milking should be performed only with dry hands. The practice of wetting the hands with milk is a filthy one; it adds bacteria and sediment to the milk, and is liable to cause the cows' teats to chap in the wintertime. Milking should be done quickly and thoroughly, without violent jerking of the teats.

After each cow is milked, the pail of milk should be removed immediately to the milk house. Pails of milk should not be allowed to stand in the barn. The milker should remember always that he is handling a human food which is very easily contaminated. Therefore it would be well that soap, clean water, and towels should be readily accessible so that the hands may be washed after milking each cow.

After milk is taken to the milk house it should be weighed, strained, and cooled at once. The object of weighing is to keep the records of the yield of each cow so as to determine the profitable and unprofitable cows in the herd. All milk should be strained to remove any dirt that may

have fallen into it. This is best done through a layer of sterile absorbent cotton placed between two clean sterilized strainer cloths, or through special straining cloth. A supply of strainer cloths should be ready for use at all times so that when one becomes soiled another can be substituted immediately. Strainer cloths should be thoroughly washed in warm water and sterilized by boiling for 5 minutes, or steaming at 205° F. or more for a similar period.

While cooling and in storage the cans of milk should be kept covered to prevent the entrance of dust, dirt, insects, and other sources of contamination. Warm, fresh milk should not be mixed with the cold milk of the previous milking, as such practice results in warming up the milk which has been previously cooled.

Milk should be properly cooled and kept cool. It should be kept in cold water until it is loaded on the wagon to go to the station or receiving plant. Bottled milk may be kept cold during transportation by the use of cracked ice placed in the crates. Cans of milk may be protected from the heat of the sun by jackets or by blankets, which will keep the milk cool and in winter will provide a covering for the milk to prevent freezing.

Milk or cream must be cooled promptly to a temperature of 50° or below if rapid bacterial growth is to be prevented.

FINALE

What are some of the benefits that the producer, the creameries, the transportation companies, the grader, and the consuming public will derive from the cream grading plan?

(a) When cream is graded the farmer who produces good cream gets paid for his extra time and work, while the one who sells second grade cream gets penalized for his careless methods.

(b) The Montana creameries are, year by year, feeling the keen competition from sections where the quality of the butter is being improved under a grading system. The market reports show that butter made from good cream is worth several cents more a pound than butter made from poor cream; therefore, good cream and poor cream should be kept separate.

(c) The transportation companies are anxious to see the dairy industry develop. Better cream means better butter. Better butter means increased consumption which calls for more shipments of raw material. Losses due to cream foaming over cans, exploding on account of gas, etc., will be very much less by having cream graded and as a consequence claims for such losses practically eliminated.

(d) Both the cream grader and the butter maker much prefer to work as such when they know and feel that they will turn out a first class product. It rests with him to exercise and use his best judgment; he must know his business and have an ideal to work for; he must be fair to the producer and to his employer alike.

(e) The consumer is the ultimate end. The necessity of making good

butter is seen in the satisfaction at the table, in the relishable wholesomeness of food cooked in it. It is noted again in the request of the housewife shopping and demanding the "best quality." It is also manifest in the very critical examination the grocer gives the butter when buying in the store of the butter broker, the wholesale house or the creamery.

No greater necessity in the dairy world today than that of making good butter.

All butter fat tests on samples of milk and cream are performed by a licensed sampler and tester. All manufacturers of the glassware used in making milk and cream tests are required to file a bond with the Commissioner of Agriculture as to the accuracy of said glassware.